

Amendment After Final
Application No. 10/775,075
Attorney Docket No. 042100

REMARKS

Claims 1-11 are pending in the application. Claims 7-9 are withdrawn. Claims 1, 2, 4-6, 10 and 11 are herein amended.

Amendment Objection - 35 U.S.C. § 132(a) / Claim Rejection - 35 U.S.C. § 112

The amendment to claims 1-6, 10 and 11 presented in the Supplemental Amendment dated April 21, 2006 was objected to under 35 U.S.C. § 132(a) and claims 1-6, 10 and 11 were rejected under 35 U.S.C. § 112, first paragraph, based on the position of the Office Action that amended claim 1 contains subject matter which was not described in the specification. The limitation at issue is “wherein knob-like projections are formed intermittently on its smooth matte side” recited in claim 1. The Office Action stated that the specification does not teach that the knob-like projections are formed intermittently and that the knob-like projections are formed on a smooth matte side.

Applicant respectfully submits that amended claim 1 is supported in the original specification. The specification at page 10, lines 16-21 states:

The thus prepared surface to be bonded to a resin substrate (bonding surface) is finished to a smooth surface of a surface roughness of 2 to 4 μm , ***has knob-like projections formed on part of the smooth matte side***, and can provide copper foil superior in high frequency transmission loss.

Therefore, the specification explicitly states that the prepared surface (1) is finished to a smooth surface and (2) has knob-like projections formed on the smooth matte side.

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The specification also discloses that knob-like projections are formed intermittently on the surface. Figs. 1-3 show the knob-like projections spaced intermittently over the surface of the copper foil. Fig. 3 most clearly shows this feature. Fig. 3 shows a mostly flat surface with projections protruding from the surface. Since there is significant space between the projections, the projections are not continuous. Rather, the projections are intermittent. Furthermore, in describing Fig. 3, the Specification states:

Fig. 3 shows the surface state of foil produced under the foil-making conditions C. The knob-like projections are small and *dispersed evenly with longer distance between them* than in Fig. 1.

(Specification, page 13 to page 14.) Therefore, the specification discloses that knob-like projections are formed intermittently on the surface.

Withdrawal of the objection to the amendment to claims 1-6, 10 and 11 under 35 U.S.C. § 132(a) and the rejection of claims 1-6, 10 and 11 under 35 U.S.C. § 112 is requested.

Support for Current Amendments

Claim 1 is amended to recite that the copper foil is an untreated copper foil. This amendment is supported by the original Specification. (*See, e.g.*, Specification, page 10, line 22 to page 11, line 3.) Claims 2, 4-6, 10 and 11 are amended for consistency with the terminology used in claim 1. Specifically, “rough surface” has been changed to “smooth matte side surface.”

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Claim Rejections - 35 U.S.C. § 102

Claims 1-6, 10 and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Fatcheric** (U.S. Patent 5,679,230); and claims 1, 2 and 4 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Wolski** (U.S. Patent 5,834,140 which corresponds exactly to Japanese Patent Publication No. 3313277 disclosed on page 6, line 8 of the present specification). Favorable reconsideration is requested.

A. Patentable Weight of the Limitation: “Projections are formed intermittently”

The Office Action takes the position that the limitation “projections are formed intermittently” is not given patentable weight since claim 1 is directed to a product. (Office Action, pages 4, 6 and 9.) The Office Action takes the position that this limitation is a method of production limitation.

Applicant respectfully submits that the limitation “projections are formed intermittently” should be construed as a structural limitation describing the arrangement of the knob-like projections on the surface of the copper foil. *See* MPEP § 2113, citing *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding “interbonded by interfusion” to limit structure of the claimed composite and noting that terms such as “welded,” “intermixed,” “ground in place,” “press fitted,” and “etched” are capable of construction as structural limitations). Just like the terms “welded” and “etched,” the term “formed” or “formed intermittently” should be construed as a structural limitation.

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Since the Office Action did not consider the limitation “projections are formed intermittently,” the rejections based on Fatcheric and Wolski are improper.

B. § 102 Rejection Based on Fatcheric

Applicant previously pointed out, (Supplemental Amendment, April 21, 2006), that Fatcheric does not disclose knob-like projections formed intermittently on the smooth matte side and a surface roughness on the smooth matte side of 2.2 to less than 4 μm as recited in claim 1. Specifically, Applicant stated that Fatcheric discloses mountains and valleys formed continuously and that the surface roughness on the matte side is 4 to 7.5 μm before and after roughening.

The Office Action takes the position that the citation to Fatcheric stating that “the matte side should be relatively smooth” does not support the conclusion that the mountains and valleys in Fatcheric are formed uniformly and continuously. (Office Action, page 9.) The Office Action also states that the instant specification does not define continuous or intermittent by any measurable variables, and thus, the matte side surface of Fatcheric is considered to be formed intermittently. (Office Action, pages 9-10.)

As stated above, the specification discloses that knob-like projections are formed intermittently on the surface. Figs. 1-3 show the knob-like projections spaced intermittently over the surface of the copper foil. Fig. 3 most clearly shows this feature. Fig. 3 shows a mostly flat surface with projections protruding from the surface. Since there is significant space between the projections, the projections are not continuous. Rather, the projections are intermittent. Furthermore, in describing Fig. 3, the Specification states:

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Fig. 3 shows the surface state of foil produced under the foil-making conditions C. The knob-like projections are small and *dispersed evenly with longer distance between them* than in Fig. 1.

(Specification, page 13 to page 14.) Therefore, the specification adequately defines the term intermittent in the context of “knob-like projections are formed intermittently on the surface.”

Applicant respectfully submits that one of ordinary skill in the art would understand the statement that “the matte side should be relatively smooth in order to assure that the grain size and orientation are suitable for etching” in Fatcheric in view of Fig. 2 of Fatcheric, means that knob-like projections are not formed on the surface intermittently as required by claim 1.

Please see the attached Fig. A which indicates schematic surface shapes of three kinds of foils. Line “a” indicates the shape of the foil of Fatcheric (Fatcheric, Fig. 2) wherein mountains are connected continuously. Line “b” indicates the shape of a foil having mountains which could be considered as intermittent by one of ordinary skill in the art, wherein the mountains are isolated. Line “c” indicates the shape of a foil which is considered as intermittent by one of ordinary skill in the art, wherein the mountains, which are knob-like projections, are isolated and a flat surface exists between the mountains.

Fatcheric does not disclose knob-like projections formed on the surface intermittently, thus Fatcheric does not disclose the elements as recited in claim 1.

Applicant respectfully submits that the Office Action improperly combines the characteristics of two separate surfaces in Fatcheric for allegedly disclosing characteristics of one surface as recited in claim 1. Claim 1 recites that one surface of the electrodeposited copper foil,

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specifically the smooth matte side, has both knob-like projections and the claimed surface roughness of 2.2 to less than 4 μm .

The Office Action cites the matte side of the copper foil for disclosing knob-like projections and the shiny side for disclosing the claimed surface roughness range of 2.2 to less than 4 μm . The Office Action cites Fig. 2 for allegedly disclosing knob-like projections. (Office Action, page 4.) Fig. 2 is a photomicrograph of the matte side of a copper foil. (Col. 3, lines 57-58.) The Office Action also explicitly cites the shiny side for disclosing the claimed surface roughness. (Office Action, page 4.)

Neither the matte side nor the shiny side disclose all of the characteristics as required to be on one surface of the smooth matte side, as recited in claim 1. Thus, Fatcheric does not disclose the elements as recited in claim 1.

Applicant respectfully submits that Fatcheric does not disclose:

wherein said rough surface having said knob-like projections and said surface roughness of 2.2 to less than 4 μm *is a surface of an untreated copper foil* for bonding with a resin substrate *and is further formed with* a copper plating layer and at least one of nickel plating, zinc plating, cobalt plating, plating of an alloy of the same and a chromate treatment layer on that

as recited in claim 6.

The Office Action cites Fatcheric at col. 5, lines 13-20 and 21-23 for disclosing the features of claim 6. (Office Action, page 5.) As stated in the previous arguments, Fatcheric at col. 5, lines 7-17 discloses depositing micro nodules of copper and a protective layer of, for

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example, zinc, nickel and cobalt. However, *Fatcheric* does not disclose forming a copper plating layer on the surface.

The Office Action also cites *Fatcheric* at col. 4, lines 49-64 for disclosing forming a copper plating layer on the surface. (Office Action, page 10.) However, this passage discloses that a continuous layer of copper, a zinc deposit, and a chromate layer are formed on a treated foil. (See, col. 4, lines 17-57.) This passage has the section heading “Treating the Foil,” and describes roughening treatments. (Col. 4, lines 24-28.) *Fatcheric* then describes encapsulating the rough copper after it has been roughening treated. (Col. 4, lines 49-57.)

Fatcheric does not disclose a copper plating layer, at least one layer of nickel plating, zinc plating, cobalt plating, plating of an alloy of the same and a chromate treatment layer on that formed on an untreated copper foil. Thus, *Fatcheric* does not disclose the elements as recited in claim 6.

Accordingly, withdrawal of the rejection of claims 1-6, 10 and 11 based on *Fatcheric* is hereby solicited.

C. § 102 Rejection Based on *Wolski*

Applicant respectfully submits that *Wolski* does not disclose “an electrodeposited copper foil wherein knob-like projections are formed intermittently on its smooth matte side surface” as recited in claim 1.

For anticipation under 35 U.S.C. § 102, the reference must teach every aspect of the claimed invention either explicitly or impliedly. (MPEP § 706.02(IV).)

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The Office Action does not state that Wolski discloses that knob-like projections are formed intermittently on its smooth matte side surface. (See Office Action, page 6.) The Office Action merely states that the citation to Wolski at col. 5, lines 31-34 is insufficient to support the conclusion that the projections of Wolski are formed continuously. (Office Action, page 10.) In other words, the Office Action states that Applicants have not provided sufficient support to demonstrate that Wolski does not disclose that knob-like projections are formed intermittently. The Office Action appears to shift the burden to the Applicant to establish that Wolski does not disclose that knob-like projections are formed intermittently. The Office Action fails to establish that Wolski discloses knob-like projections that are formed intermittently, and thus, the rejection based on Wolski is improper.

Furthermore, Applicant provided support demonstrating that Wolski actually discloses a copper foil having a shape of continuous mountains by citing to Wolski at col. 1, lines 11-13 and col. 5, lines 31-34. (Supplemental Amendment, April 21, 2006, page 8.) The Office Action only considered our citation to col. 5, lines 31-34. (Office Action, page 10.)

Wolski at col. 5, lines 31-34 states:

By using the above organic compound in combination with 3-mercaptopropanesulfonate, copper crystal can be made fine and *a plating surface having less unevenness can be obtained.*

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In addition, Wolski at col. 1, lines 11-13 states: “the untreated copper foil according to the present invention has *flatter surfaces on both surfaces* as compared with conventional ones.”

One of ordinary skill in the art would understand that a surface having less unevenness and which is flatter does not have knob-like projections formed intermittently on the surface. In addition, one of ordinary skill in the art would understand that the matte side of an electrodeposited copper foil, as disclosed in Wolski, has a shape of continuous mountains.

Wolski also discloses that an object of the invention in Wolski is to provide a copper foil which has a high etching factor without lowering peeling resistance and accomplishing fine patterning without remaining copper particles. (Col. 4, lines 12-16.) Generally, to achieve such a copper foil, the copper foil is smooth and continuous, because if there are intermittent projections, residual coppers are easily generated at the points of projections, and the straight characteristic of the pattern might deteriorate.

Therefore, Wolski does not disclose that an electrodeposited copper foil wherein knob-like projections are formed intermittently on its smooth matte side surface as recited in claim 1.

Applicant respectfully submits that Wolski does not disclose an untreated electrodeposited copper foil with a smooth matte side surface wherein the “surface roughness thereof is 2.2 to less than 4 μm ” and “wherein the copper foil is an untreated copper foil” as recited in amended claim 1.

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The Office Action states that Wolski teaches a surface roughness of 3.3 to 3.7 μm on the matte side citing to comparative example 1 in tables 2 and 3. (Office Action, page 10.) However, comparative example 1 is not an electrodeposited copper foil as required by claim 1. In describing comparative examples 1 and 2, Wolski states that the copper foils of comparative examples 1 and 2 are prepared in the same manner as in Examples 1-4 except that electrolysis is not carried out on the copper foils. (Col. 8, lines 19-22.) Therefore, comparative example 1 does not meet the requirements of claim 1.

Wolski discloses in example 2, a surface roughness of the untreated copper foil of 2.1 μm , (col. 9, Table 2), and a surface roughness after roughening treatment of 2.2 μm , (col. 11, Table 3, “Surface roughness and etching property *after bond enhancing treatment*”). The surface roughness of the copper foil, in example 2, before treatment does not meet the requirements of claim 1. Thus, Wolski does not disclose the elements as recited in claim 1.

Accordingly, withdrawal of the rejection of claims 1, 2 and 4 based on Wolski is hereby solicited.

Claim Rejections - 35 U.S.C. § 103

Claims 3, 5, 6, 10 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolski in view of Fatcheric. Favorable reconsideration is requested.

The Office Action stated that “the remaining arguments presented in 10-11 are directed to inherent properties of the copper foil and matter that is not claimed, and are therefore not relevant.” (Office Action, page 10.) Applicant assumes that this statement in the Office Action

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is referring to the demonstration of unexpected results presented in the Supplemental Amendment for overcoming the § 103 rejection.

Applicant respectfully submits that the demonstration of unexpected results is not only relevant, but also overcomes the § 103 rejection for obviousness. The MPEP states:

Objective evidence or secondary considerations such as *unexpected results... are relevant* to the issue of obviousness and must be considered in every case in which they are present.

MPEP § 2141(III). The MPEP also states that when analyzing an invention for obvious, the invention must be delineated as a whole which includes: “those properties of the subject matter which are *inherent in the subject matter* and are disclosed in the specification.” MPEP § 2141.03(V).

Applicant’s presentation of unexpected results is relevant for overcoming the obviousness rejection under § 103. Therefore, the unexpected results should have been considered.

Applicant respectfully submits that claims 3, 5, 6, 10 and 11 are not obvious over *Wolski* in view of *Fatcheric* since the present invention as recited in claims 3, 5, 6, 10 and 11 provides the unexpected result of an electrodeposited copper foil having a high frequency property and high peel strength.

The electrodeposited copper foil of the present invention has high peel strength and excellent high frequency property. Neither *Fatcheric* nor *Wolski* direct attention to a high frequency property. The present invention discloses forming knob-like projections intermittently on the smooth matte side surface of the untreated foil thereby allowing for roughening treating of

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the untreated foil to be performed under a weak condition. Based on the experimental result that the high frequency property depends on strength of roughening treating, the present invention realizes both a high frequency property and high peel strength because only a weak roughening treatment is performed. The fact that the knob-like projection is formed intermittently is an important reason why both the high frequency property and high peel strength can be achieved in the present invention.

Note that it is not possible for a *Fatcheric*-type copper foil to realize both a high frequency property and high peel strength, as disclosed in page 5, lines 9 to 15 of the present specification. There is no description in *Fatcheric* about achieving a high frequency property. Furthermore, *Fatcheric* cannot achieve good high frequency property because the surface roughness on the matte side of the copper foil is too large, and the mountains and valleys are formed continuously.

Note also that a *Wolski*-type copper foil needs strong roughening treatment to obtain high peel strength which brings about deterioration of the high frequency property, as written at page 6, lines 19 to 23 of the present specification. Thus, the copper foil in *Wolski* cannot achieve both a high frequency property and a high peel strength property. *Wolski* discloses that low profiling of a matte side is required for a finely patterned printed circuit board, (col. 2, lines 23-31), however there is no description about the high frequency property. The present inventor engaged

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in the development of the copper foil of the present invention because the copper foil of *Wolski* cannot satisfy both the high frequency property and high peel strength. (Specification, page 6, line 7 to page 7, line 2.)

Please see the attached Table B which summarizes Tables 1 and 8 of the present specification. Table B indicates peel strength and transmission loss (high frequency property) of a copper foil of the present invention and copper foils according to Fatcheric and Wolski respectively.

The present invention as recited in claims 3, 5, 6, 10 and 11 provides the unexpected result of an electrodeposited copper foil having a high frequency property and high peel strength. Thus, claims 3, 5 and 6 are non-obvious over Wolski in view of Fatcheric.

Accordingly, withdrawal of the rejection of claims 3, 5, 6, 10 and 11 based on Wolski in view of Fatcheric is hereby solicited.

In view of the aforementioned amendments and accompanying remarks, Applicant submits that the claims, as herein amended, are in condition for allowance. Applicant requests such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

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If this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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AGM/tw
Enclosures: FIG. A
Table B



FIG. A

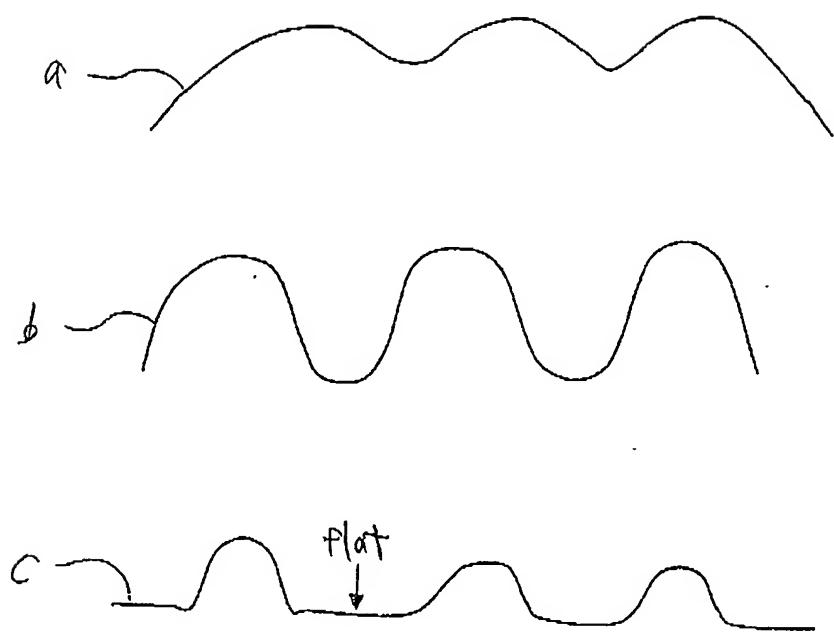


Table B

FOIL	SURFACE ROUGHNESS OF ORIGINAL FOIL (BEFORE ROUGHENING)	ROUGHENING CURRENT DIVIDED BY ROUGHENING SPEED (TREATMENT STRENGTH)	SURFACE ROUGHNESS (AFTER ROUGHENING)	PEEL STRENGTH	TRANS- MISSION LOSS	CITED PORTION
PRESENT EXAMPLE	2.4	200A·min./m	2.55	1.21	3.62	TABLE 8
CORRES- PONDING TO FATCHERIC	4.74	400A·min./m	2.9	1.22	3.7	TABLE 8
CORRES- PONDING TO WOLSKI	0.8	300A·min./m	5.14	0.92	3.92	TABLE 1
CORRES- PONDING TO WOLSKI	0.8	200A·min./m	0.9	0.59	3.64	TABLE 8
		400A·min./m	0.9	0.60	3.71	TABLE 8

